NASA TECH BRIEF

Marshall Space Flight Center

A Vacuum Chamber Feedthrough

The problem:

In the study of simulated micrometeroid impacts, the radiation emitted from the plasma produced by the impact is measured with a pulsed photomultiplier system. Because the photomultiplier must be placed in a vacuum chamber, a matched impedance vacuum feedthrough is needed.

The solution:

A simple and inexpensive microwave feedthrough has been designed which transfers a 130 ns, 5kV pulse into the vacuum chamber. The feedthrough may be used over a wide range. It is adaptable to most coaxial cables, since either a multistrand or a single strand center conductor cable can be used.

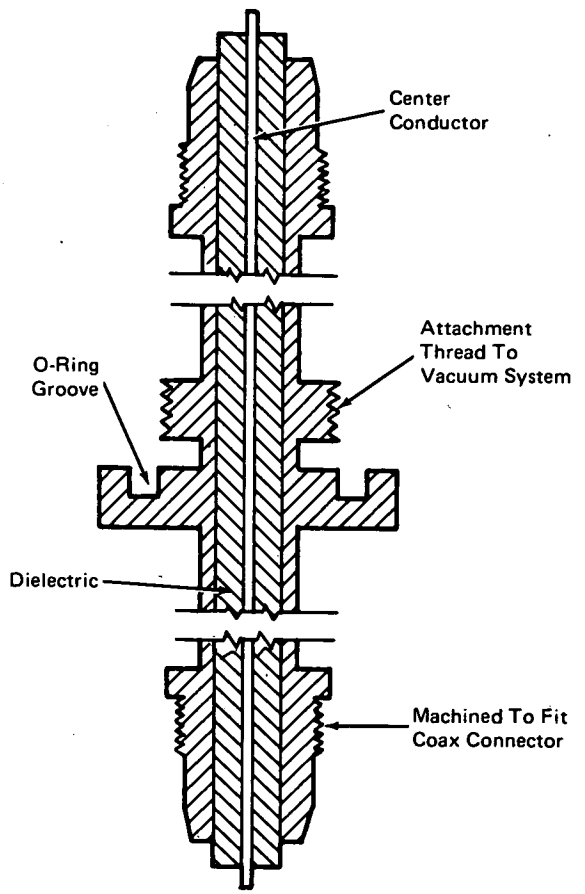
How it's done:

The device consists of a brass fitting with a coaxial cable and a dielectric running down the center. (See the figure for the description of a sample feedthrough.) The center hole is drilled to a diameter 0.08 to 0.13 mm (0.003 to 0.005 in) less than the diameter of the dielectric to be used. After selecting the coaxial cable, the insulation and shielding is removed, leaving only the center conductor and dielectric. If the cable has a multistrand center conductor, it must be replaced by a single strand with a diameter calculated by the following formula:

$$Z = (138 / \sqrt{\epsilon_R}) \log_{10}(b/a)$$

where ϵ_R is the relative permittivity of center hole filling line; b is the inside radius of the center hole in the brass; a is the diameter of the center conductor; and Z is the desired characteristic impedance.

To insert the dielectric and coaxial center conductor, first cool them in liquid nitrogen and quickly place them inside the brass jacket. The subsequent expansion forms a tight seal, making crimping unnecessary. Finally, attach the brass fitting to a flat surface on the vacuum vessel by means of a threaded hole.



Matched Impedance Vacuum Feedthrough

(continued overleaf)

Note:

Requests for further information may be directed to:

Technology Utilization Officer
Marshall Space Flight Center
Code A&PS-TU
Marshall Space Flight Center, Alabama 35812
Reference: B73-10152

Patent status:

NASA has decided not to apply for a patent.

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